2018 Sulfur Dioxide (SO_2) Data Summary Report

Indiana Department of Environmental Management (IDEM)
Office of Air Quality

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About This Report

The Indiana Department of Environmental Management (IDEM) collects and analyzes outdoor air samples for regulated pollutants, including sulfur dioxide (SO_2). Monitoring is conducted for SO_2 year round, as mandated by United States Environmental Protection Agency (U.S. EPA), and the data is reported to U.S. EPA's Air Quality System (AQS). This ***2018 Sulfur Dioxide (SO_2) Data Summary Report*** provides an overview of SO_2 and its impacts, national air health standards, Indiana's SO_2 monitoring network, a summary of 2018 SO_2 monitoring data, air quality trends over the last ten years, and the status of SO_2 designations in Indiana.

What is Sulfur Dioxide (SO_2)?

SO_2 is one of several highly reactive gases in a larger group of gases known as sulfur oxides (SO_x). Highly reactive gases are those that have a high potential to change in composition under certain conditions of pressure, temperature or light, or upon contact with another chemical. For example, SO_2 that is released into the atmosphere can dissolve in water vapor to form acid rain. Emissions of SO_2 generally lead to formation of other SO_x. SO_x can react with other compounds to form small particles and contribute to particulate matter (PM) pollution. At high concentrations, SO_x can damage foliage and decrease the growth of trees and plants. Of all the gases in the SO_x group, SO_2 is most prevalent in the atmosphere and considered to pose the greatest public health concerns.

Where does SO_2 come from? SO_2 can come from natural sources, like volcanic activity, but also from several manmade sources:

- Fossil fuel combustion at power plants and other industrial facilities.
- Industrial processes such as extracting metal from ore.
- Locomotives, large ships and non-road equipment that use high-sulfur fuels.

What are the health effects of exposure to SO_2? Breathing SO_2 has been linked to an array of adverse respiratory effects including:

- Narrowing of the airways leading to breathing difficulty (bronchoconstriction).
- Increased asthma symptoms, especially during exercise.
- Increased visits to emergency departments and hospital admissions for respiratory illnesses.

National Ambient Air Quality Standards (NAAQS) for SO_2

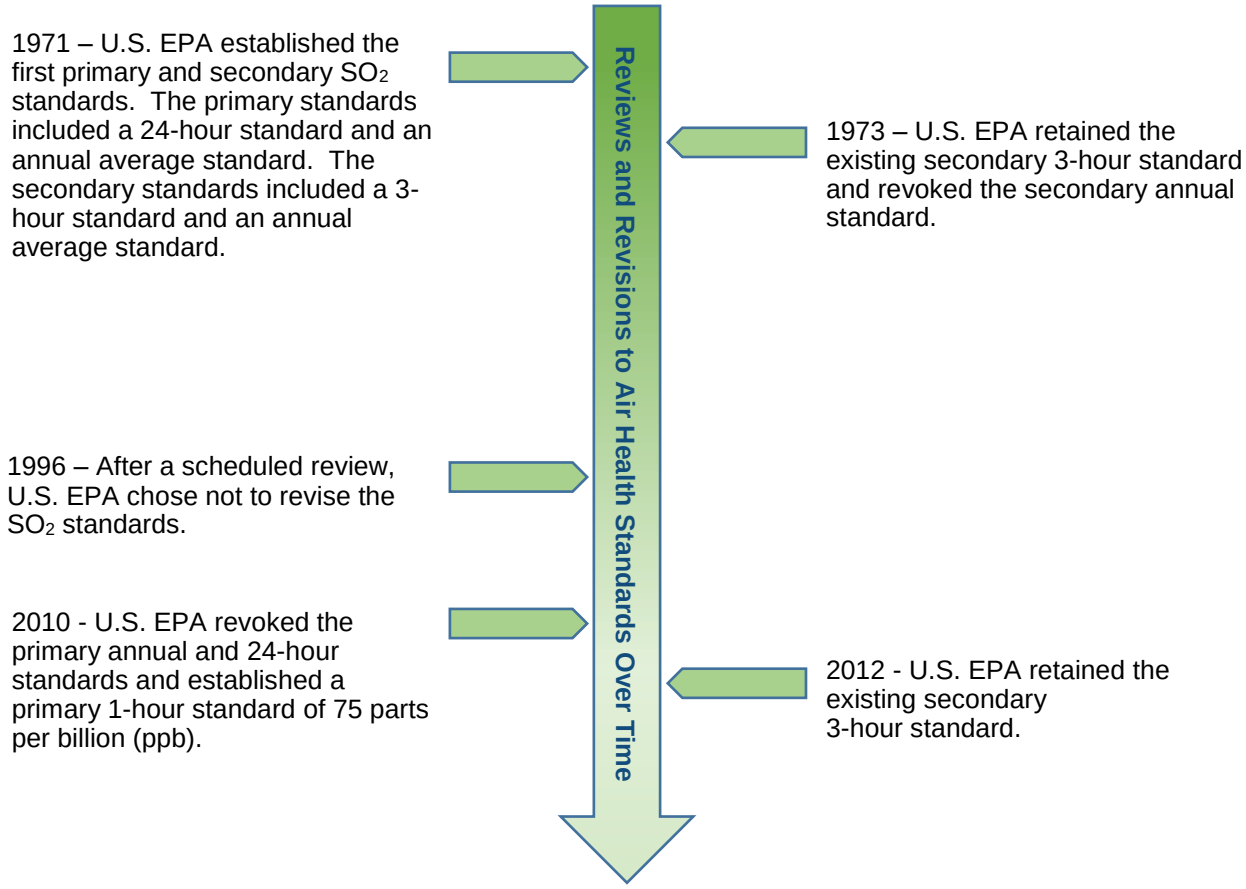
The federal Clean Air Act requires U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) for common outdoor air pollutants, including SO_2. The standards for SO_2 are designed to prevent adverse impacts from all of the SO_x gases. NAAQS, which are also known as air health standards, include:

- Primary standards for public health, which set pollutant limits to protect the most vulnerable groups such as young children, the elderly and individuals with respiratory illnesses.

- Secondary standards for public welfare, which set limits to protect visibility and prevent damage to animals, crops, vegetation, and buildings.

Since the primary and secondary standards were first established for SO_2 in 1971, revisions have been made to both. The 1971 primary standards included both a 24-hour standard of 0.14 parts per million (ppm) not to be exceeded more than once per year and an annual average standard of 0.03 ppm. Both 1971 primary standards were revoked in 2010 and replaced by a more stringent 1-hour primary standard of 75 parts per billion (ppb). The 1971 secondary standards included both a 3-hour standard of 0.5 ppm not to be exceeded more than once per year and an annual average standard of 0.02 ppm. The 1971 secondary annual standard was revoked in 1973. The 1971 secondary 3-hour standard remains in effect. The timeline in Figure 1 notes these milestones in the NAAQS development over the years.[1]

Figure 1:
History of the SO_2 NAAQS



[1] Source, U.S. EPA: https://www3.epa.gov/ttn/naaqs/standards/so2/s_so2_history.html.

Attaining the SO_2 Standards

Air quality monitoring data must measure at or below concentrations set by U.S. EPA for three complete, consecutive years to be in attainment of the NAAQS. For example, an evaluation in 2020 will be based on data from 2017 through 2019.

How does an area attain the primary 1-hour standard? An area is determined to be attaining the primary 1-hour SO_2 NAAQS when the 99th percentile of the daily maximum 1-hour concentrations, averaged over three years, does not exceed 75 parts per billion (ppb).

What is a design value? The three year average of the 99th percentile of the daily maximum 1-hour concentrations is referred to as the **design value**. A monitor's design value is calculated at the end of the year, once all of the data has been quality assured.

What is the difference between an exceedance and a violation? When a monitor records a concentration above the limit established by the NAAQS, it is referred to as an **exceedance**. A monitor can have an exceedance without being in **violation** of the standard. If a monitor's three-year design value exceeds the NAAQS, the monitor is in violation.

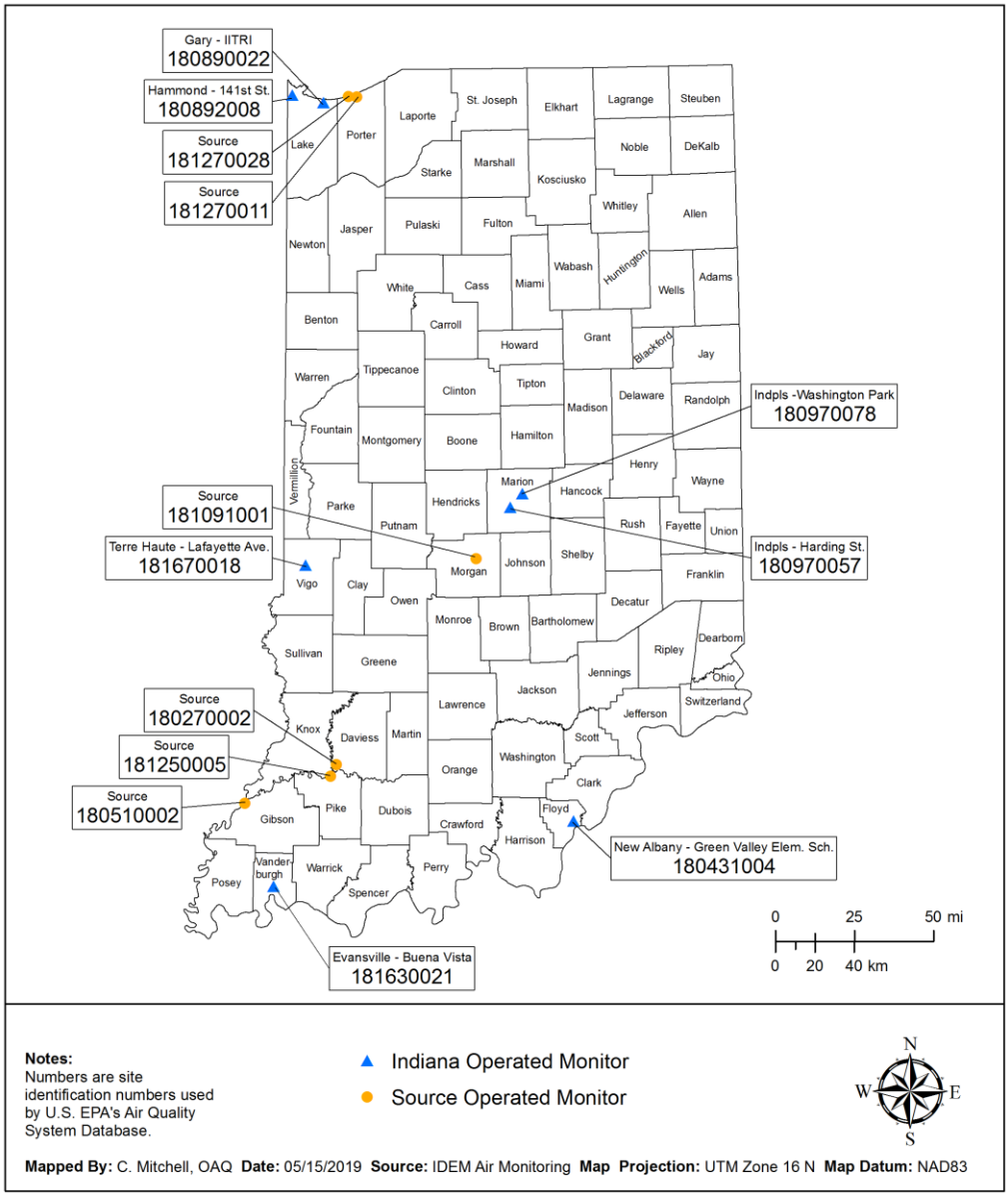
2018 SO_2 Monitoring Network

Indiana's 2018 monitoring network included seven SO_2 monitors in five Indiana counties. The placement of SO_2 monitors in Indiana's network is determined according to U.S. EPA guidance on factors including population and manufacturing levels. IDEM conducts annual reviews of the monitoring network, which are published each year in the *Indiana Ambient Air Monitoring Network Plan* at https://www.in.gov/idem/airquality/2389.htm.

In addition to the monitors operated by IDEM, six source-oriented SO_2 monitors were operated by SO_2 emissions sources in five Indiana counties.

Figure 2 shows SO_2 monitor locations in Indiana for 2018.

Figure 2:
SO_2 Monitoring Network, 2018



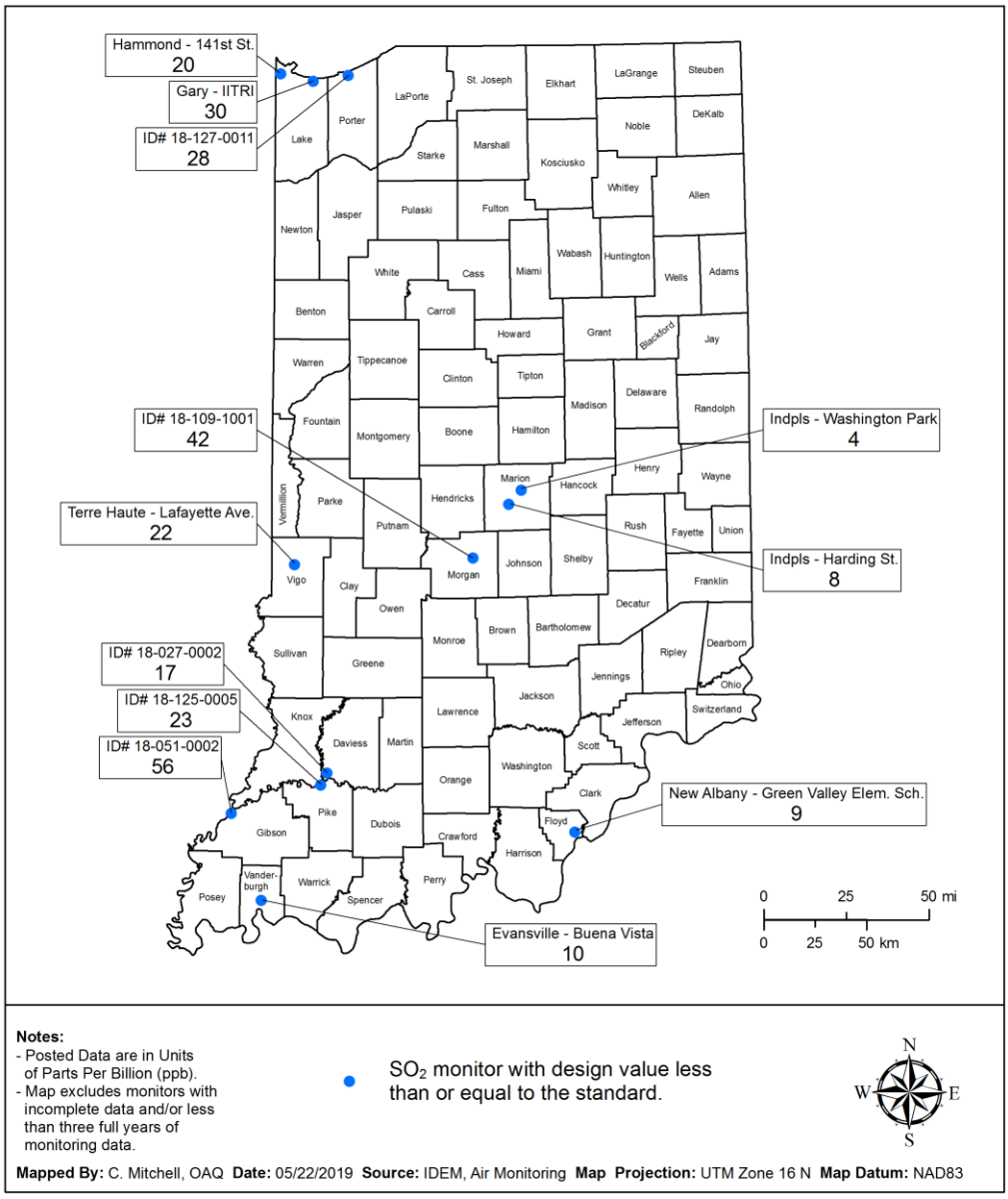
2018 SO_2 Monitoring Data Summary

SO_2 monitoring data has been quality assured for 2018.

2018 Monitoring Data: In 2018, 99th percentile maximum values for all IDEM and source-oriented SO_2 monitors were below the primary 1-hour standard.

Design Values for 2016-2018: For 2016-2018, design values for all IDEM and source-oriented SO_2 monitors were below the primary 1-hour standard, as shown in Figure 3.

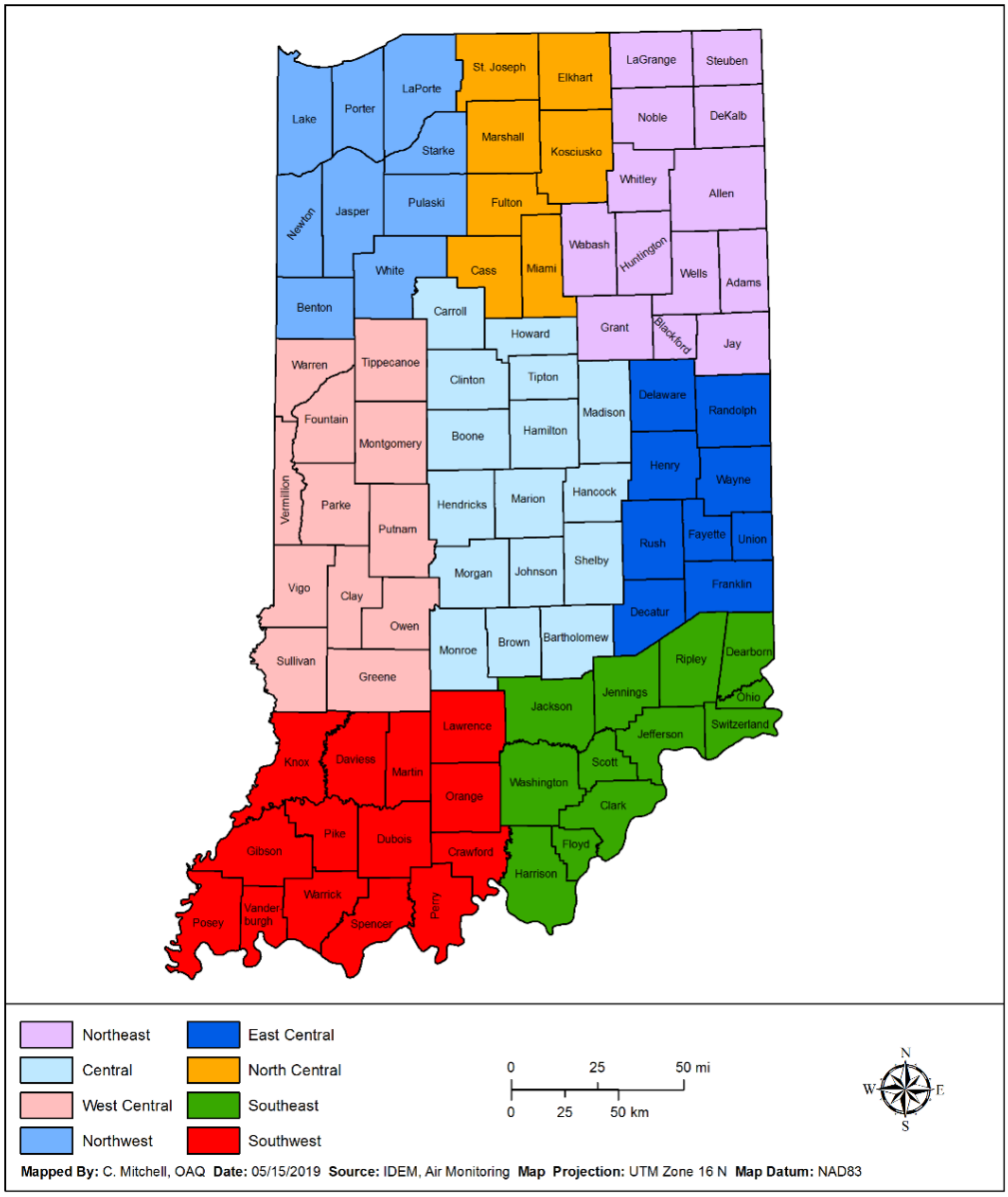
Figure 3:
Design Values for the Primary 1-Hour SO_2 Standard, 2016-2018



SO_2 Air Quality Trends, 2009-2018

An analysis of SO_2 monitoring data shows SO_2 air quality trends over the last 10 years. To display the data, the state has been divided into regions, as shown in Figure 4.

Figure 4:
Areas of Indiana



The annual 99th percentile daily maximum concentrations for 2009-2018 are plotted in comparison with the primary 1-hour standard in Chart 1. Downward trends are illustrated by monitor design values for 2007-2009 through 2016-2018, which are plotted in Chart 2.

Chart 1:
SO_2 99th Percentile Value Trends, 2009 Through 2018

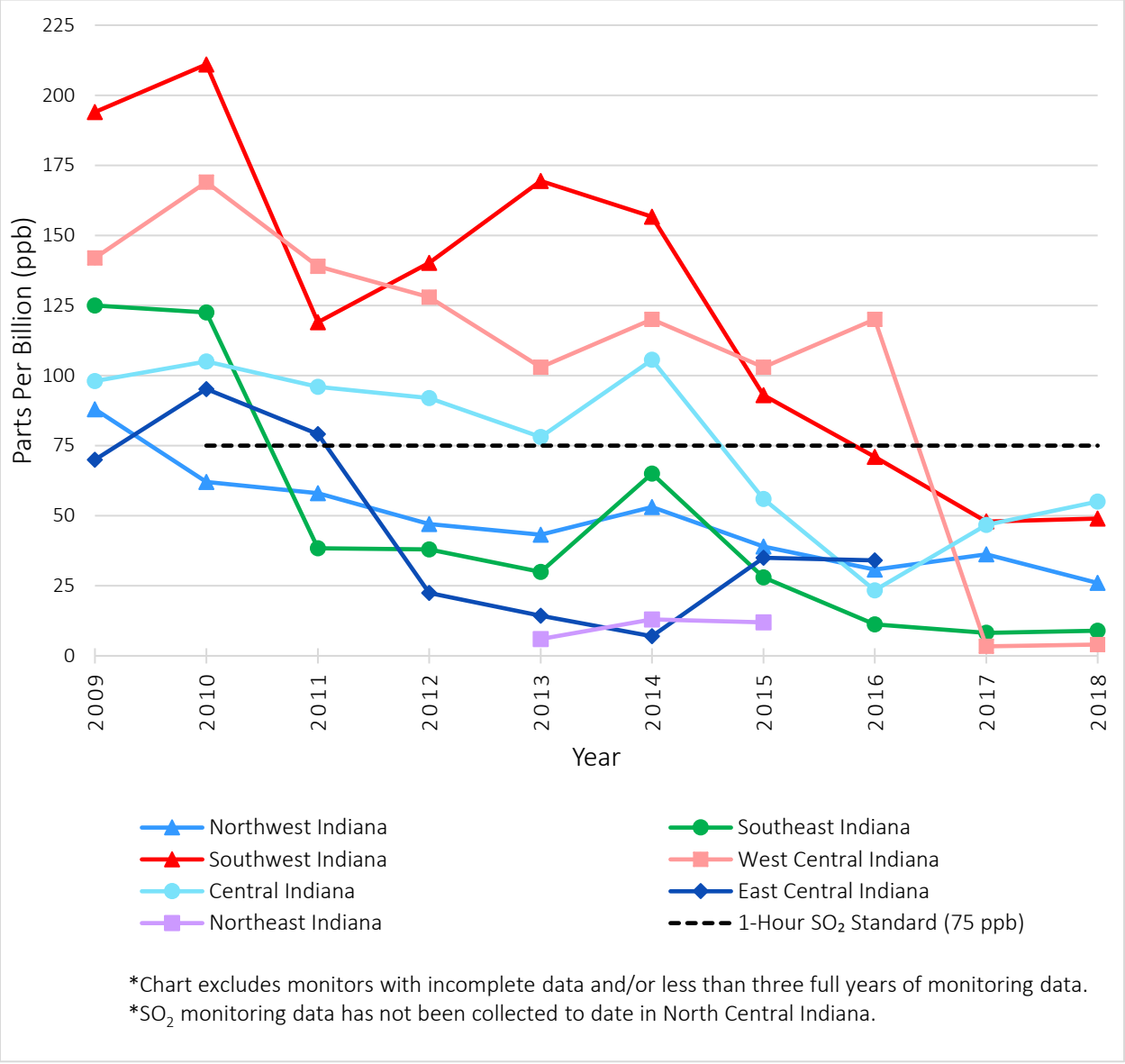


*Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.
*SO_2 monitoring data has not been collected to date in North Central Indiana.

Chart 2:
SO_2 Design Value Trends, 2007-2009 Through 2016-2018

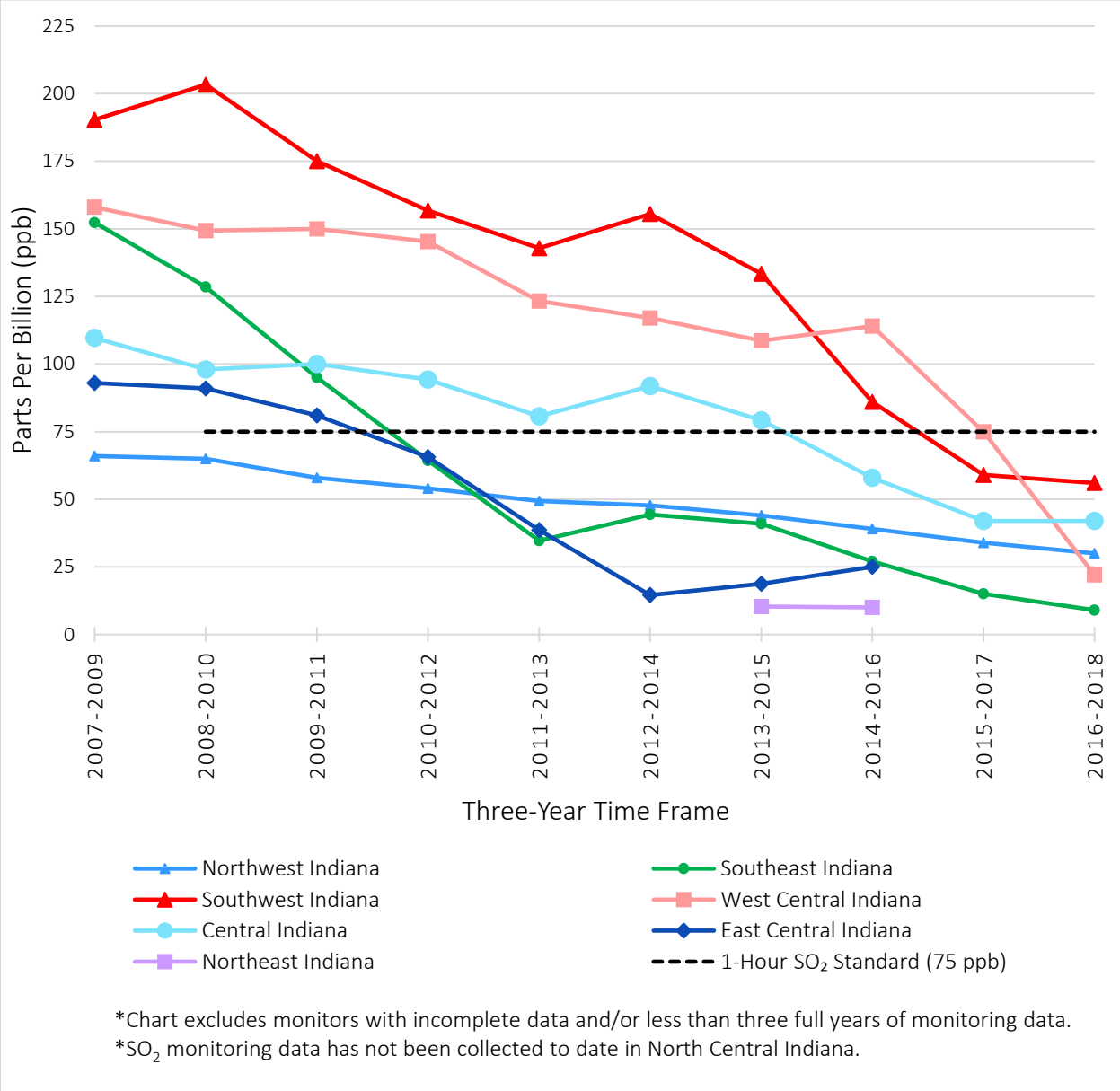


*Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.
*SO_2 monitoring data has not been collected to date in North Central Indiana.

Status of SO_2 Designations

When a NAAQS is issued, the implementation process begins. The first step is for U.S. EPA to designate air quality for all areas of the country. Areas that are not attaining the new standard and areas that are contributing to areas that are not attaining the standard are designated as nonattainment. When a nonattainment area attains the standard, IDEM ensures it is formally recognized for its compliance and redesignated to attainment status.

2010 Primary 1-Hour NAAQS: On July 25, 2013, U.S. EPA issued designations for areas with existing SO_2 monitors that violated the primary 1-hour standard, referred to as Round 1 designations. Portions of Daviess, Marion, Morgan, Pike and Vigo counties were designated as nonattainment in Round 1 based on 2009-2011 monitoring data (78 FR 47191).[2] More recent data shows that all monitors are achieving the standard. Indiana has been and will continue working closely with U.S. EPA on the submission of attainment demonstrations, maintenance plans, and timely requests for the redesignation of these areas to attainment status. Table 1 shows the most recent actions to date.

Table 1:
Round 1 Designations Under the 2010 Primary 1-Hour SO_2 NAAQS

Area	County/Township	Current Status
Southwest Indiana, IN	Daviess County: Veale Township	Nonattainment: Redesignation petition and maintenance plan submitted to U.S. EPA on October 24, 2018.
Indianapolis, IN	Marion County: Center, Perry and Wayne Townships	Nonattainment: U.S. EPA proposed approval of the redesignation petition and maintenance plan on April 17, 2019 (84 FR 18195).
Morgan County, IN	Morgan County: Clay and Washington Townships	Nonattainment: Attainment demonstration and technical support document submitted to U.S. EPA on October 2, 2015. Supplement submitted on February 8, 2019.
Southwest Indiana, IN	Pike County: Washington Township	Nonattainment: Redesignation petition and maintenance plan submitted to U.S. EPA on October 24, 2018.
Terre Haute, IN	Vigo County: Fayette and Harrison Townships	Nonattainment: U.S. EPA proposed approval of the redesignation petition and maintenance plan on April 24, 2019 (84 FR 19007).

As a result of a Consent Decree and subsequent court order, U.S. EPA was required to complete designations for the remainder of the country in three additional rounds. Round 2 designations were issued on June 30, 2016, and included unmonitored areas around certain large sources of SO_2 emissions that were identified according to U.S. EPA Air Markets Database.[3] Designations were based on data from air models, which are computer-generated air quality predictions based on weather and emissions data. As shown in Table 2, Gibson County, Jefferson County (partial), LaPorte County, Posey County (partial) and Spencer County (partial) were designated as attainment/unclassifiable in Round 2 (81 FR 45039).

[2] Federal Register (FR) notices (cited by volume and page number) can be viewed at https://www.federalregister.gov/.
[3] Areas that recorded new monitor violations since Round 1 were also addressed in Round 2; however, no new monitor violations were recorded in Indiana.

Table 2:
Round 2 Designations Under the 2010 Primary 1-Hour SO_2 NAAQS

Source	County/Area	Current Status
Duke Energy Gibson Station	Gibson County	Attainment/Unclassifiable
IKEC Clifty Creek Station	Jefferson County: Graham, Lancaster, Madison, Monroe, Republican, Shelby and Smyrna Townships	Attainment/Unclassifiable
NIPSCO Michigan City Station	LaPorte County	Attainment/Unclassifiable
Vectren A.B. Brown Station	Posey County: Bethel, Center, Harmony, Lynn, Marrs, Robb, Robinson, and Smith Townships	Attainment/Unclassifiable
AEP Rockport Station	Spencer County: Ohio Township north of UTM 4187.580 km northing, and Carter, Clay, Grass, Hammond, Harrison, and Jackson Townships	Attainment/Unclassifiable

Round 3 designations were issued on December 21, 2017, based on modeling data for areas around SO_2 emissions sources identified as being subject to U.S. EPA's Data Requirements Rule (DRR)[4], except where sources installed new monitors for the purpose of designations, and all remaining areas. As shown in Table 3, a designation of attainment/unclassifiable was issued for all Round 3 areas of Indiana, except for Huntington Township in Huntington County (83 FR 1098).

[4] The DRR was finalized on August 10, 2015 (80 FR 51051). View a copy at https://www.govinfo.gov/content/pkg/FR-2015-08-21/pdf/2015-20367.pdf.

Table 3:
Round 3 Designations Under the 2010 Primary 1-Hour SO_2 NAAQS

Source	County/Area	Current Status
Duke Energy Gallagher Station	Floyd	Attainment/Unclassifiable
U.S. Mineral Products Isolatek	Huntington County: Huntington Township	Nonattainment: On March 9, 2018, IDEM submitted a petition to U.S. EPA requesting that it reconsider the nonattainment designation and reclassify the township as "unclassifiable."
NIPSCO R.M. Schahfer Station	Jasper	Attainment/Unclassifiable
ISPAT Cokenergy	Lake	Attainment/Unclassifiable
U.S. Steel Gary Works		
ArcelorMittal Indiana Harbor		
SABIC Innovative Plastics	Posey	Attainment/Unclassifiable
Hoosier Energy Merom Station	Sullivan	Attainment/Unclassifiable
Duke Energy Cayuga Station	Vermillion	Attainment/Unclassifiable
ALCOA Warrick Power Plant	Warrick	Attainment/Unclassifiable
ALCOA Warrick Operations		
All remaining areas of Indiana, except Porter County.		Attainment/Unclassifiable

The fourth and final round of designations will be issued by December 31, 2020, for areas around DRR sources that elected to install new monitors. Porter County is the only remaining undesignated area of Indiana and will be designated in Round 4 using monitoring data, as shown in Table 4.

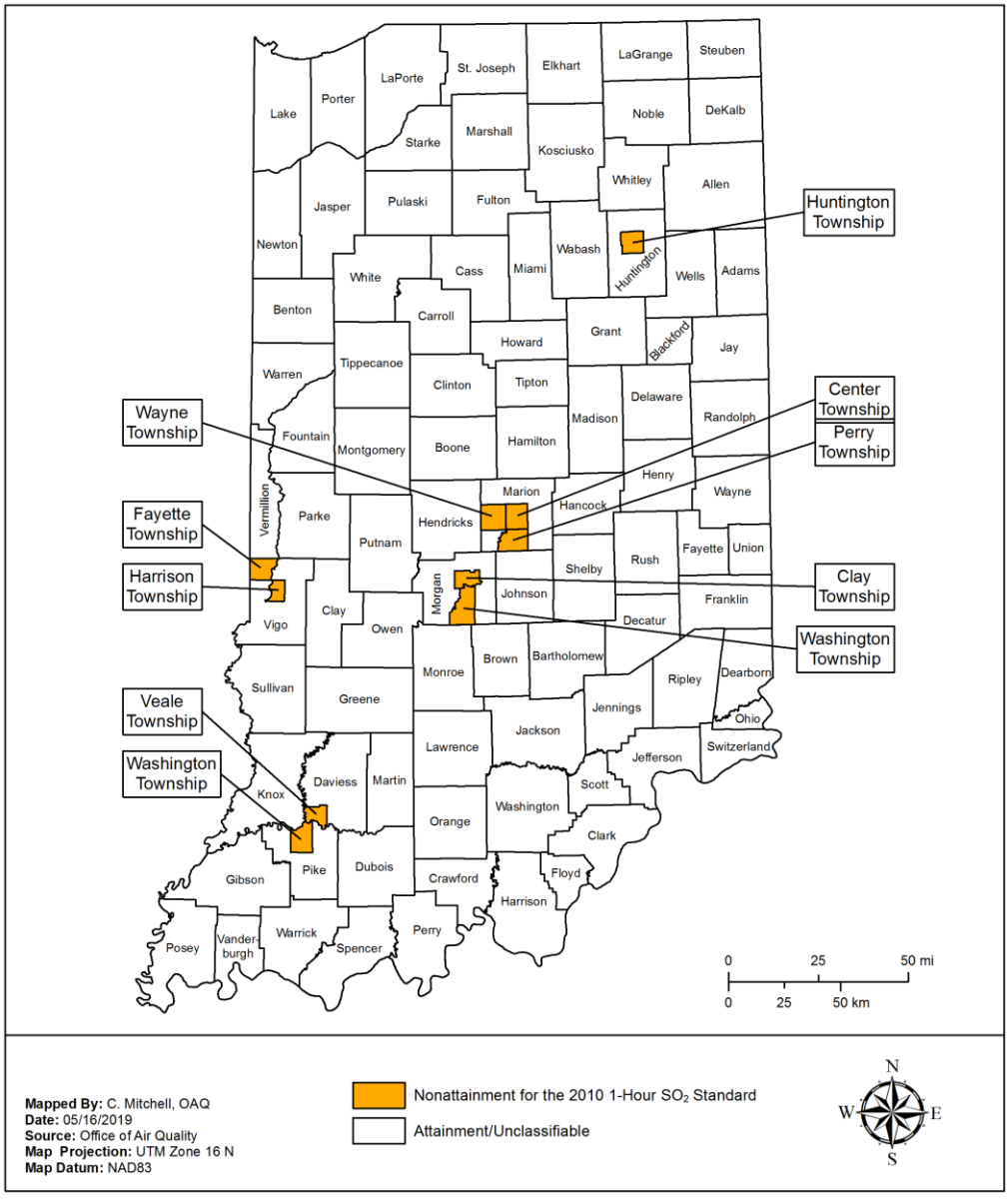
Table 4:
Round 4 Designations Under the 2010 Primary 1-Hour SO_2 NAAQS

Source	County/Area	Current Status
ArcelorMittal Burns Harbor	Porter County	U.S. EPA will issue the designation by December 31, 2020, based on 2017-2019 data from new monitors installed near the source.

<u>Secondary 3-Hour SO_2 NAAQS</u>: Indiana has never had any nonattainment areas for the secondary 3-hour SO_2 standard.

Indiana's SO_2 nonattainment areas are shown in Figure 5.

Figure 5:
Nonattainment Areas Under the 2010 Primary 1-Hour SO_2 Standard



Additional Information

- Daily air quality forecasts: https://www.in.gov/idem/airquality/pages/smogwatch/index.htm. Sign up for email or text alerts: https://public.govdelivery.com/accounts/INDEM/subscriber/topics.
- Continuous monitoring data and air quality reports: https://www.IN.gov/idem/airquality/2346.htm.
- Air quality designations, nonattainment plans, redesignation petitions and maintenance plans: https://www.IN.gov/idem/airquality/2343.htm.
- U.S. EPA information about SO_2 pollution and NAAQS implementation: https://www.epa.gov/naaqs.
- U.S. EPA AQS: https://www.epa.gov/aqs.

Contact IDEM's Office of Air Quality

Please feel free to direct questions or comments to Ms. Amy Smith, environmental manager with IDEM's Office of Air Quality, at (800) 451-6027 Option 4 (*toll free*), (317) 233-8211 (*direct*), or amsmith@idem.IN.gov (*email*).